

Sciurus deppei. By Troy L. Best

Published 20 October 1995 by The American Society of Mammalogists

Sciurus deppei Peters, 1863

Deppe's Squirrel

Sciurus deppei Peters, 1863:654. Type locality "Mexico, Papantla" (=Papantla, Veracruz, Mexico—Nelson, 1899:101).

Macroxus tephrogaster Gray, 1867:431. Type locality "Mexico."

Macroxus taeniurus Gray, 1867:431. Type locality "Guatemala."

Sciurus negligens Nelson, 1898:147. Type locality "Alta Mira, Tamaulipas, Mexico."

Sciurus miravallensis Harris, 1931:1. Type locality "Volcan de Miravalles at an altitude of 1,500 feet . . . in the Cordellera de Guanacaste of northwestern Costa Rica."

CONTEXT AND CONTENT. Order Rodentia, Suborder Sciurognathi, Family Sciuridae, Subfamily Sciurinae, Genus *Sciurus*, Subgenus *Sciurus* (Wilson and Reeder, 1993). Based upon structure of the hyoid bones, *S. deppei* also has been placed into the subgenus *Neosciurus* (Hoffmeister and Hoffmeister, 1991). The genus *Sciurus* contains 28 species (Wilson and Reeder, 1993). Five subspecies of *S. deppei* are recognized (Hall, 1981):

S. d. deppei Peters, 1863:654, see above (*tephrogaster* Gray and *taeniurus* Gray are synonyms).

S. d. matagalpae Allen, 1908:660. Type locality "San Rafael del Norte, Nicaragua."

S. d. miravallensis Harris, 1931:1, see above.

S. d. negligens Nelson, 1898:147, see above.

S. d. vivax Nelson, 1901:131. Type locality "Apazote, Campeche, Mexico."

DIAGNOSIS. In portions of its range, *S. deppei* may be sympatric with *S. alleni*, *S. aureogaster*, *S. granatensis*, *S. oculatus*, *S. richmondi*, *S. variegatoides*, and *S. yucatanensis*. Compared with *S. aureogaster* (total length, 418–573 mm), *S. variegatoides* (total length, 510–560), and *S. yucatanensis* (total length, 450–500), *S. deppei* (total length, 343–387 mm) is much smaller. Compared with *S. alleni* (total length, 415–493 mm) and *S. oculatus* (total length, 530–560 mm), which are larger and have one upper premolar, *S. deppei* is smaller and has two upper premolars (Fig. 1) instead of one upper premolar. Compared with *S. richmondi*, which is similar in size and has one upper premolar, *S. deppei* has two upper premolars (Hall, 1981). Where their ranges overlap in Costa Rica, *S. deppei* is smaller than *S. granatensis*; *S. deppei* has a dark and narrow tail, brown body, small and pale postauricular patches (Heaney, 1983), the underparts are gray instead of ferruginous or buff, and *S. deppei* also has the hairs of the tail tipped with white instead of ferruginous (Goodwin, 1946).

GENERAL CHARACTERS. The upperparts of *S. deppei* vary from grizzled dark rusty brown to yellowish brown and even to grayish brown. The outside of the legs and feet usually are dark gray. Dorsally, the tail is black and thinly washed with white. Ventrally, the tail varies from ochraceous to rich ferruginous, and has a black border with the hairs having white or pale-yellow tips. The underparts usually are white or yellowish to dull rufous, but the buffy patches of the inguinal, axillary, and gular regions extend well onto the venter of some individuals (Hall, 1981).

There is considerable individual variation within *S. d. deppei*, but despite its wide distribution there is little geographic variation. Seasonal changes in pelage are not marked, the only notable differences are the frequent absence, in summer, of the ear patches and white tip of the tail, which thus is entirely black. There are no records of melanism. Individuals from the vicinity of Jico and Las Vigas, Veracruz, and elsewhere at higher elevations in the range of this subspecies, are considerably larger than those from lower elevations, but without accompanying differences in color. Those in the moist forests of eastern Mexico are somewhat darker along the middle

of the back, with underparts more inclining to fulvous than are those from interior and western Chiapas. Individuals from the vicinity of the type locality usually have the outside of the forelegs and forefeet finely grizzled with dark gray, contrasting with the back, but in

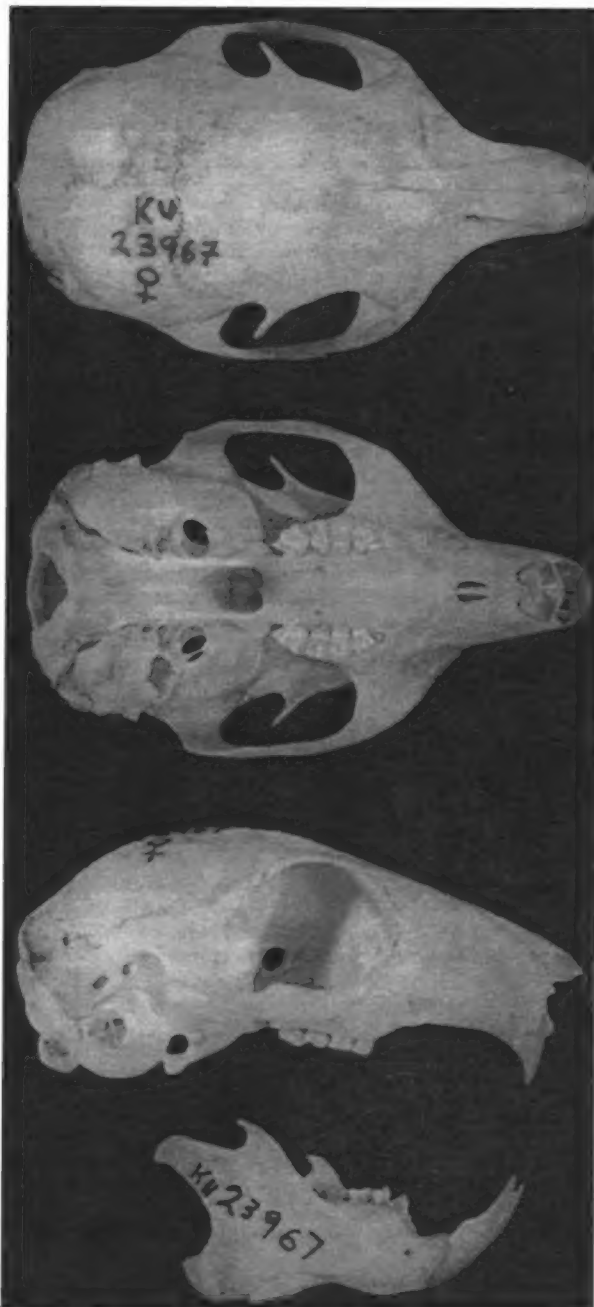


FIG. 1. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Sciurus d. deppei* from 35 km SE Jesus Carranza, 120 m elevation, Veracruz, Mexico (female, University of Kansas Museum of Natural History 23967). Greatest length of cranium is 45.5 mm.

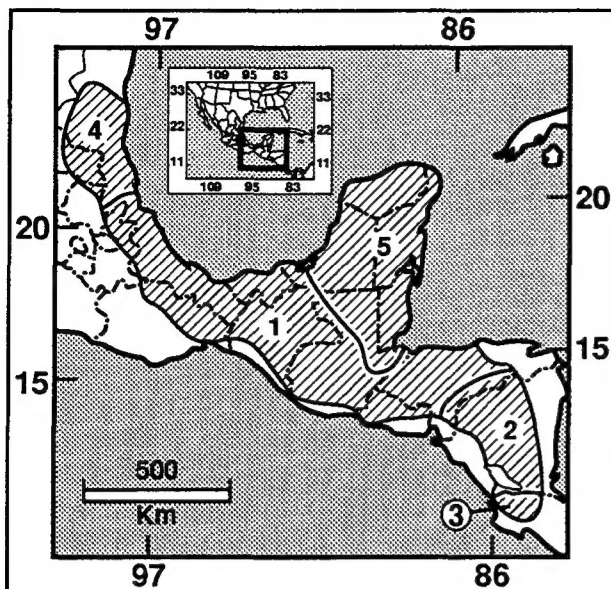


FIG. 2. Distribution of *Sciurus deppei* in Central America (Hall, 1981; Jones et al., 1983; León-Paniagua et al., 1990): 1, *S. d. deppei*; 2, *S. d. matagalpae*; 3, *S. d. miravallensis*; 4, *S. d. negligens*; 5, *S. d. vivax*.

individuals from farther south the color of the back usually extends over the forelegs and feet (Nelson, 1999).

The main variation in *S. d. negligens* is in the amount of rusty on the ears and in the color of the underparts, which ranges from white to deep buffy yellow. Some individuals are considerably grayer above, i.e., less shaded with yellow, than others. No melanistic individuals are known. There are no seasonal differences among *S. d. negligens* in spring and autumn (Nelson, 1999). In San Luis Potosí, individual variation in *S. d. negligens* is slight. Occasionally, the upperparts are darker or paler and the tail sometimes is more reddish. The underparts are never white (Dalquest, 1953).

Average external and cranial measurements (in mm) of *S. d. deppei* and *S. d. negligens*, respectively, are: total length, 384, 387; length of tail, 182, 188; length of hind foot, 54, 54; basal length of cranium, 42.5, 41.7; palatal length, 21.6, 21.4; interorbital breadth, 15.2, 15.3; zygomatic breadth, 28.6, 28.4; length of upper toothrow, 9.2, 9.1 (Nelson, 1999). Mass (in g) of four adult males and an adult female *S. d. deppei* from Hidalgo, respectively, was 266.3, 285.3, 287.5, 294.4, and 258.4 (Jones et al., 1983), average mass in Veracruz was 190 (Estrada and Coates-Estrada, 1985), and mass of three adults from Chiapas was 246, 292, and 301 (Kuns and Tashian, 1954).

Compared with *S. d. deppei*, *S. d. negligens* has longer ears that are dull rusty, the upperparts are pale grayish-brown, and the underparts are white or pale buffy yellow (Nelson, 1999). Compared with *S. d. deppei*, *S. d. vivax* is similar in color, but much paler, more rusty reddish on the upperparts; the outside of the forelegs, feet, and side of the shoulders are gray; the top of the tail is more heavily washed with white; and the underparts are white or grayish white, distinctly clearer than in *S. d. deppei* and with no trace of buffy suffusion. Cranially, *S. d. vivax* has a heavier rostrum, broader nasals, and smaller and rounder auditory bullae than *S. d. deppei* (Nelson, 1901).

DISTRIBUTION. Deppe's squirrel occurs from northern Costa Rica northward along the mountains on both coasts of Guatemala and Chiapas to the Isthmus of Tehuantepec, and then along the east coast of Mexico into Tamaulipas. It usually occupies elevations of <300 m, but occurs sporadically up to $\geq 3,000$ m (Fig. 2; Goodwin, 1934; Jones et al., 1983; Hall, 1981; León-Paniagua et al., 1990; Nelson, 1999).

FOSSIL RECORD. The genus *Sciurus* evolved by the early Miocene (Black, 1972). Remains that may be of *S. deppei* have been recovered from Recent deposits in caves on the Yucatán Peninsula (Hatt et al., 1953).

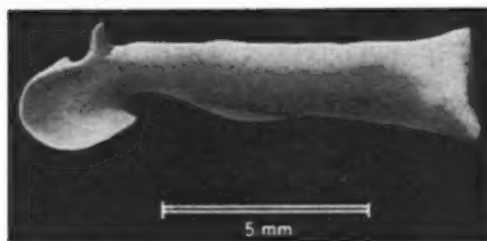


FIG. 3. Baculum of *Sciurus deppei negligens* from Sierra de Tamaulipas, Tamaulipas, Mexico (modified from Burt, 1960).

FORM AND FUNCTION. The dental formula is $i\ 1/1, c\ 0/0, p\ 2/1, m\ 3/3$, total 22 (Hall, 1981). The hyoid apparatus consists of a single basihyal and paired thyrohyals, ceratohyals, and stylohyals; the basihyal is thick, triangular in cross-section, long, and fuses with the short thyrohyals at an early age (Hoffmeister and Hoffmeister, 1991).

The pelage is soft and rather dense, but not sleek. The hair is 11 mm long in the middorsal area, 35 mm long near the center of the tail, and 50 mm long near the tip of the tail (Dalquest, 1953). In Hidalgo, an adult male was molting on the head, shoulders, upper back, and on the midpart of the venter on 24 July (Jones et al., 1983).

The proportion of length of forelimb to length of trunk is 0.60, and length of hind limb to length of trunk is 0.85. Limb proportions are: radius to humerus, 0.95; tibia to femur, 1.12; humerus to femur, 0.79; radius to tibia, 0.67; radius plus humerus to tibia plus femur, 0.72 (Thorington and Heaney, 1981).

The baculum of *S. deppei* (Fig. 3) is most like bacula of *S. alleni* and *S. granatensis*. The basal portion of the shaft is circular or nearly so in cross-section. The shaft tapers distally, with an apparent twist, to its smallest diameter. At this point the shaft usually curves dorsally and expands into a broad circular disc that is concave on the right side and convex on the left. Ventral to this expanded disc is a definite spur. There is a small supplementary spur anterior to the main one on the ventral side. The expanded tip comes to a definite point posterodorsally, and a notch is formed with the shaft. There is a definite dorsal keel on the shaft. Measurements (in mm) of two bacula of *S. d. miravallensis* from Costa Rica, one of *S. d. deppei* from Guatemala, and one of *S. d. negligens* from Tamaulipas, respectively, are: length, 9.8, 10.0, 10.0, 11.1; length of expanded tip, 2.7, 3.0, 2.5, 2.6; height of tip, 3.0, 3.1, 3.2, 2.8; height of base, 3.3, 3.6, 2.9, 2.5; width of base, 2.5, 2.5, 2.3, 2.3 (Burt, 1960).

The baubellum of *S. deppei* is similar to that of *S. carolinensis*, but the baubellum of *S. deppei* has a relatively longer, oval-shaped disc whose dorsal rim does not curl over. The right face of the disc also is less concave and the crest on the left face is less pronounced. Length of the baubellum is 3.8 mm, and width of the disc is 2.1 mm (Layne, 1954).

Sciurus d. deppei and *S. d. matagalpae* each have three pair of functional mammae, whereas *S. d. negligens* possesses four pair. *S. deppei* is the only species of *Sciurus* known to characteristically have three pair of functional mammae; other species have four pair (Moore, 1961).

ONTOGENY AND REPRODUCTION. Deppe's squirrel breeds throughout the year (Hall and Kelson, 1959), but it is not known how many litters an individual may bear each year. It is possible that individuals may be confined to one litter a year, but overall, the species may produce young each month (Moore, 1961). Litter size usually is four, but varies from two to eight (Hall and Kelson, 1959).

In Veracruz, males had enlarged testes in November, March, and April (Hall and Dalquest, 1963); in San Luis Potosí, males had enlarged and scrotal testes 22–29 June (Davis, 1944), and in Querétaro, males had scrotal testes 1 August (León-Paniagua et al., 1990). In Campeche, a female had two embryos (12 mm in crown-rump length) on 18 December (Jones et al., 1974). In Hidalgo, a female was lactating on 29 July, and four males had testes that were 24, 25, 25, and 28 mm long, whereas testes of two young-of-the-year were 6 and 8 mm long (Jones et al., 1983). In Tamaulipas, adult females had no embryos on 18–22 March, but recently had been lactating (Hooper, 1953). In Tamaulipas, females were lactating

in January (Baker, 1951) and February, but not in May and June (Alvarez, 1963). One female had four placental scars, three on the right side and one on the left, along with a resorbed embryo on the right side (Alvarez, 1963). In San Luis Potosí, young were born in early July, postlactating females were observed in late July, and nearly grown young were present in November (Dalquest, 1953). In Chiapas, a young adult with a mass of 192 g was present 7 July–5 August (Kuns and Tashian, 1954). In San Luis Potosí, young animals sometimes are more woolly than adults, but other young are sleek (Dalquest, 1953).

In Yucatán, one female *S. deppei* held in captivity may have mated with a *S. yucatanensis*. She gave birth in February to five young, some of which resembled one parent, some the other. These offspring survived to adulthood, but whether they were fertile is not known (Gaumer, 1917; Leopold, 1959).

ECOLOGY. Deppe's squirrel occurs in the dense forests on the hot coastal plains and the shady depths of humid tropical forests on the lower mountain slopes where the damp air produces a thick growth of trees and parasitic plants (Nelson, 1899). In Veracruz, *S. deppei* seems to prefer dense forest, where there is little light. Near Gutiérrez Zamora, it was common in dense forest, the trees of which seldom were >9 m in height or 13 cm in diameter at the base. Here the overhead vegetation was so dense that the ground beneath was only dimly lighted. In southern Veracruz, Deppe's squirrel was abundant in dense forests at low elevations. It was found in the deepest part of the forest, where most of the trees were >30 m tall, but most were seen on or near the ground. None was observed >15 m from the ground. *S. deppei* seems to prefer vine-covered trees, and trees with numerous cavities, such as the strangler fig (*Ficus*—Hall and Dalquest, 1963). The climate in Veracruz is hot and humid, with an average annual temperature of 27°C. Rainfall is seasonal, with a dry season (average, 112 mm) from March to May and a wet season (average, 486 mm) from June to February. Average annual precipitation is 4,900 mm (Estrada and Coates-Estrada, 1985).

In Tamaulipas, Deppe's squirrel is abundant in areas where tall trees and dense brush prevail (Alvarez, 1963). *S. deppei* occurs in oak-sweetgum (*Quercus-Liquidambar*) forest, oak woods, dry subtropical woods, and dense tropical growth (Hooper, 1953), and it is common in tropical-deciduous and cloud forests at 200–1,500 m elevation (Baker, 1951; Goodwin, 1954).

In San Luis Potosí, *S. deppei* ranges throughout the tropical areas, but is most common in the upland forests on the slopes of the Sierra Madre Oriental and less so in woods on the coastal plain (Dalquest, 1953). Bordering the Río Axtla, Deppe's squirrel occurred in tall mango (*Mangifera indica*) trees along the river (Davis, 1944). It was most numerous in the stunted forests of ebony (*Diospyros*), 5–8 m tall, which cover great areas in the range of *S. deppei*. *S. deppei* was common at Velasco, San Luis Potosí, where the ground under the trees was strewn with gnawed seed pods (Nelson, 1899).

In Querétaro, Deppe's squirrel is common in the oak forest (León-Paniagua et al., 1990), and in Hidalgo, it is a common inhabitant of lowland and mid-elevation tropical forest and pine-oak (*Pinus-Quercus*) forest (Jones et al., 1983). In Oaxaca, *S. deppei* occurs in humid tropical and austral zones, on the Gulf of Mexico drainage at <1,800 m elevation, and sporadically up to 2,850 m elevation (Goodwin, 1969). In Oaxaca, more *S. deppei* were observed in the entangled undergrowth and on the ground than in tall trees (Musser, 1968).

In Chiapas, Deppe's squirrel was common in the cloud forest near Finca Prusia (Leopold, 1959; Villa R., 1948), and on the mountains above Tapachula (Nelson, 1899). In the tall pine trees, heavily covered with lianas and epiphytic plants, *S. deppei* was hard to see (Leopold, 1959; Villa R., 1948). One was observed traveling across some large boulders along the base of a cliff. The vegetation was a mature tropical forest with a few species typical of the forest edge (Warner and Beer, 1957).

In Guatemala, *S. deppei* is most common in dense humid tropical forests at <1,800 m elevation, although it occurs up to 3,000 m elevation. Deppe's squirrel may be common at one locality and at another similar tract of forest, it is rare or absent (Goodwin, 1934). In Belize, *S. deppei* occurs in forests where much of the land along the river has been cleared, but where some tracts of virgin forest still exist (Murie, 1935). In Costa Rica, Deppe's squirrel lives in coastal lowlands, deciduous forest, and accompanying riparian vegetation below ca. 400 m elevation, and in evergreen forests and

associated pastures and fields at 1,500–1,900 m elevation (Wilson, 1983); many of the sight records outside northwestern Guanacaste Province actually may be of *S. granatensis* (M. D. Engstrom, in litt.).

In Veracruz, density of *S. deppei* was 100 individuals/km², and the average size of home range was 1.5 ha (Estrada and Coates-Estrada, 1985). Occasionally, great aggregations of Deppe's squirrels are found. Two large groups were observed in March of two different years in the rainforest of the Selva del Ocote, Chiapas. A high population was present in a semi-wilderness near San Juan, Campeche, where new cornfields were being cleared in the rainforest. There, around the edges of the fields, dozens of Deppe's squirrels were active, living on corn. In areas where the forest is impoverished after being cut over several times, *S. deppei* becomes scarce or disappears even though corn is readily available (Leopold, 1959).

Nests are made in hollow tree trunks and in balls of leaves and twigs among the higher branches (Hall and Nelson, 1959). In Veracruz, *S. deppei* was never observed to enter holes in trees, but probably does so. Leaf nests were common. Most nests were ca. 30 cm in diameter and placed on larger limbs >7.5 m from the ground. Some were on slender main trunks not far from the tops of trees (Hall and Dalquest, 1963). In San Luis Potosí, one to three ball-like leaf nests, each ca. 30 cm in diameter, were found in some trees. Nests were 2–6 m from the ground in dense mango trees (Dalquest, 1953). In Tamaulipas, a nest 23–25 cm in diameter and constructed of leaves and small sticks, was in a thick tangle of branches 8 m above the ground (Alvarez, 1963).

Deppe's squirrel is a granivore and folivore. In Veracruz, its food usually is composed of 95% fruit and 5% leaves; dry mass of fruit removed is 6 kg ha⁻¹ year⁻¹ (Estrada and Coates-Estrada, 1985), and *S. deppei* also may consume seeds of the tree *Cymbopetalum baillonii* (Coates-Estrada and Estrada, 1988). In Oaxaca, Deppe's squirrel spends much time on the ground feeding on fungi, acorns, and berries growing in the tangled understory (Musser, 1968). In Chiapas, *S. deppei* eats the fruits of such trees as the moju (*Brosimum*—Leopold, 1959). In Belize, Deppe's squirrel feeds on nuts of cohune palms (*Orbygnia cohune*). At some times of the year, it moves onto the pine (*Pinus caribaea*) ridges to feed on acorns (Murie, 1935).

Deppe's squirrel rarely comes into contact with agriculture, but when it does, it is capable of doing great damage, especially to corn. This may occur where a cornfield is situated in a clearing in dense forest. The squirrels climb the stalks, and without detaching the ears of corn, cut away the husks to reach the kernels. They begin gnawing at the tip and rarely eat more than one-half the kernels of one ear. It is a common sight in such a cornfield to see ears of corn half-eaten with the bottom of the ear still swathed in its husks, but several centimeters of the bare cob, from which the corn has been eaten, projecting. *S. deppei* is too small to be worth hunting for food (Baker, 1951; Dalquest, 1953; Hall and Dalquest, 1963; Leopold, 1959).

The geographic ranges of *S. deppei* and *S. aureogaster* broadly overlap in southern Mexico and Guatemala (Hall, 1981). The two species occur sympatrically in San Luis Potosí (Davis, 1944), Veracruz (Hall and Dalquest, 1963), Hidalgo (Jones et al., 1983), Oaxaca (Musser, 1968), and Guatemala (Goodwin, 1934). In eastern Mexico, *S. deppei* occurs with *S. aureogaster* down the slopes toward the Gulf of Mexico to at least 2,240 m elevation. From there down to 700 m elevation, *S. aureogaster* is not present, but *S. deppei* is common. *S. aureogaster* (and probably *S. deppei*) occurs at lower elevations; *S. deppei* occurs in the lowlands where stands of deep relatively undisturbed forest remain (Musser, 1968).

In Veracruz, *S. deppei* often occurs with *S. aureogaster*, but seems never to enter the open palm forest, where *S. aureogaster* often is common. Near Papantla, there are two hills separated by only a few hundred meters of low, forested valley. On one hill only *S. deppei* was found, whereas on the other only *S. aureogaster* was found. On other nearby hills, both species are found together (Hall and Dalquest, 1963).

Sciurus deppei occupies dense vegetation and may be more terrestrial than *S. aureogaster* (Hall and Dalquest, 1963), *S. granatensis*, and *S. variegatoides* (Heaney, 1983). On the Yucatán Peninsula, *S. deppei* frequently occurs with *S. yucatanensis* (Jones et al., 1974). In the Chiapas-Guatemala region, *S. deppei* is sympatric with *S. variegatoides* (Musser, 1968), and may be sympatric with *Synthosciurus brochus* in Costa Rica (Wells and Giacalone, 1985). In Veracruz, *S. deppei* occurs in the same area as *Ateles*

geoffroyi, *Bassariscus sumichrasti*, *Caluromys derbianus*, *Coendou mexicanus*, *Cyclopes didactylus*, *Didelphis marsupialis*, *Marmosa mexicana*, *Philander opossum*, *Potos flavus*, *Sciurus aureogaster*, and *Tamandua mexicana* (Estrada and Coates-Estrada, 1985), and in Guatemala, *S. deppei* occurs with *Alouatta villosa*, *Ateles geoffroyi*, *Dasyprocta punctata*, *Eira barbara*, *Mazama americana*, *Nasua nasua*, *Odocoileus virginianus*, *Potos flavus*, *Sciurus yucatanensis*, and *Tayassu tajacu* (Cant, 1977).

Ectoparasites include the chigger *Eutrombicula alfreddugesi* (Loomis, 1969), the lice *Enderleinellus deppei* (Kim, 1966) and *E. extremus* (Ferris, 1951), and the fleas *Trichopsylla graphis* (da Costa Lima and Hathaway, 1946), *Kohlsia graphis*, and *Plusaetis dolens* (Traub et al., 1983). No ectoparasites were found in Veracruz (Hall and Dalquest, 1963). No endoparasites are known.

BEHAVIOR. Deppe's squirrel is diurnal (Estrada and Coates-Estrada, 1985) and is active throughout the day (Alvarez, 1963). *S. deppei* is relatively inactive compared with other *Sciurus*, and only rarely is it seen on twigs and small branches (Dalquest, 1953). Deppe's squirrel essentially is arboreal (Hall and Kelson, 1959), but spends much time on the ground (Baker, 1951; Cant, 1977; Nelson, 1899) seeking nuts, seeds, buds, insects, and fruits (Hall and Kelson, 1959); 30–60% of its foraging time is spent on the ground (Estrada and Coates-Estrada, 1985). Deppe's squirrel is most active on the ground from sunrise to ca. 1000 h and just before dark (Goodwin, 1954).

When in trees, *S. deppei* is in lower levels (0–10 m) ca. 30% of the time, mid-levels (10–20 m) ca. 40% of the time, and upper levels (>20 m) ca. 30% of the time (Estrada and Coates-Estrada, 1985). Deppe's squirrel is agile, moves rapidly through trees, can leap remarkably long distances from one branch to another (Hall and Kelson, 1959), and rarely rustles leaves and branches. *S. deppei* usually is found on the tree trunks and larger branches. At the approach of a human, Deppe's squirrel slips around to the far side of a trunk or large limb, and remains motionless. It usually is observed as a silhouette against the leaves overhead (Hall and Dalquest, 1963); because of its dark color *S. deppei* blends with the darkness in the profusely foliated trees, making it inconspicuous except when it is in motion (Davis, 1944).

Deppe's squirrel is quiet and not often heard, although occasionally one will chatter and scold at an intruder (Murie, 1935; Nelson, 1899). On the Cerro Pelon, Oaxaca, it is vociferous and calls throughout the day. The call sometimes is a high-pitched and bird-like trill, but more often it is a series of high-pitched notes emitted close together. *S. deppei* often is found in aggregations of up to six or seven in a grove of trees calling to each other (Musser, 1968). When vocalizing, there is a pronounced twitching of the tail (Goodwin, 1954).

Sciurus deppei is common in some areas, but does not seem to be social to any degree (Hall and Dalquest, 1963). Nothing is known concerning the genetics of *S. deppei*.

REMARKS. *Sciurus* is from the Latin meaning squirrel (Jaeger, 1955). The specific epithet *deppei* is in recognition of F. Deppe (Peters, 1863). *S. deppei* also has been referred to as the Orizaba (Allen, 1877), Tampico (Nelson, 1898), Zapote (Nelson, 1901), Apazote (Elliot, 1904), little gray (Nelson, 1899), Guanacaste (Goodwin, 1946), and little dull squirrel (Dalquest, 1953). The Spanish name is ardilla montañera or ardilla chica (Baker, 1951; Hall and Dalquest, 1963).

I thank L. L. Thornton, A. M. Coffman, and other personnel in the Interlibrary Loan Department at Auburn University R. B. Draughon Library for assistance in obtaining articles from other institutions, T. D. Haas for help in locating literature, W. B. Robinson for helping in the preparation of Fig. 1, and T. Rodriguez for preparing Fig. 2. M. D. Engstrom, R. S. Lishak, R. E. Mirarchi, and E. C. Oaks critically evaluated an early draft of the manuscript. This is journal article no. 15-933612 of the Alabama Agricultural Experiment Station.

LITERATURE CITED

- ALLEN, J. A. 1877. Sciuridae. Pp. 631–939, in *Monographs of North American Rodentia* (E. Coues and J. A. Allen). Report of the United States Geological Survey of the Territories, 11: 1–1091.
- . 1908. Mammals from Nicaragua. *Bulletin of the American Museum of Natural History*, 24:647–670.
- ALVAREZ, T. 1963. The Recent mammals of Tamaulipas, México. University of Kansas Publications, Museum of Natural History, 14:363–473.
- BAKER, R. H. 1951. Mammals from Tamaulipas, Mexico. University of Kansas Publications, Museum of Natural History, 5:207–218.
- BLACK, C. C. 1972. Holarctic evolution and dispersal of squirrels (Rodentia: Sciuridae). *Evolutionary Biology*, 6:305–322.
- BURT, W. H. 1960. *Bacula of North American mammals*. Miscellaneous Publications of the Museum of Zoology, University of Michigan, 113:1–76.
- CANT, J. G. H. 1977. A census of the agouti (*Dasyprocta punctata*) in seasonally dry forest at Tikal, Guatemala, with some comments on strip censusing. *Journal of Mammalogy*, 58:688–690.
- COATES-ESTRADA, R., AND A. ESTRADA. 1988. Frugivory and seed dispersal in *Cymbopetalum baillonii* (Annonaceae) at Los Tuxtlas, Mexico. *Journal of Tropical Ecology*, 4:157–172.
- DA COSTA LIMA, A., AND C. R. HATHAWAY. 1946. *Pulgas: bibliografía, catálogo e animais por elas sugados*. Monografias do Instituto Oswaldo Cruz, 4:1–522.
- DALQUEST, W. W. 1953. *Mammals of the Mexican state of San Luis Potosí*. Louisiana State University Press, Baton Rouge, 229 pp.
- DAVIS, W. B. 1944. Notes on Mexican mammals. *Journal of Mammalogy*, 25:370–403.
- ELLIOT, D. G. 1904. The land and sea mammals of Middle America and the West Indies. Field Columbian Museum Publication, Zoological Series, 4:1–439.
- ESTRADA, A., AND R. COATES-ESTRADA. 1985. A preliminary study of resource overlap between howling monkeys (*Alouatta palliata*) and other arboreal mammals in the tropical rain forest of Los Tuxtlas, Mexico. *American Journal of Primatology*, 9:27–37.
- FERRIS, G. F. 1951. The sucking lice. *Memoirs of the Pacific Coast Entomological Society*, 1:1–320.
- GAUMER, G. F. 1917. *Monografía de los mamíferos de Yucatan*. Departamento de Talleres Graficos de la Secretaria de Fomento, Mexico City, Mexico, 331 pp.
- GOODWIN, G. G. 1934. Mammals collected by A. W. Anthony in Guatemala, 1924–1928. *Bulletin of the American Museum of Natural History*, 68:1–60.
- . 1946. Mammals of Costa Rica. *Bulletin of the American Museum of Natural History*, 87:271–474.
- . 1954. Mammals from Mexico collected by Marian Martin for the American Museum of Natural History. *American Museum Novitates*, 1689:1–16.
- . 1969. Mammals from the state of Oaxaca, Mexico, in the American Museum of Natural History. *Bulletin of the American Museum of Natural History*, 141:1–269.
- GRAY, J. E. 1867. Synopsis of the species of American squirrels in the collection of the British Museum. *Annals and Magazine of Natural History*, series 3, 20:415–434.
- HALL, E. R. 1981. The mammals of North America. Second ed. John Wiley and Sons, New York, 1:1–600 + 90.
- HALL, E. R., AND W. W. DALQUEST. 1963. The mammals of Veracruz. University of Kansas Publications, Museum of Natural History, 14:165–362.
- HALL, E. R., AND K. R. KELSON. 1959. The mammals of North America. The Ronald Press Company, New York, 1:1–546 + 79.
- HARRIS, W. P., JR. 1931. A new squirrel of the *Sciurus hoffmanni* group from Costa Rica. *Occasional Papers of the Museum of Zoology, University of Michigan*, 277:1–3.
- HATT, R. T., H. I. FISHER, D. A. LANGEBAEDEL, AND G. W. BRAINERD. 1953. Faunal and archeological researches in Yucatan caves. *Bulletin of the Cranbrook Institute of Science*, 33:1–119.
- HEANEY, L. R. 1983. *Sciurus granatensis* (ardilla roja, ardilla chisa, red-tailed squirrel). Pp. 489–490, in *Costa Rican natural history* (D. H. Janzen, ed.). The University of Chicago Press, Chicago, 816 pp.
- HOFFMEISTER, R. G., AND D. F. HOFFMEISTER. 1991. The hyoid in North American squirrels, Sciuridae, with remarks on associated musculature. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología*, 62: 219–234.
- HOOPER, E. T. 1953. Notes on mammals of Tamaulipas, Mexico.

- Occasional Papers of the Museum of Zoology, University of Michigan, 544:1-12.
- JAEGER, E. C. 1955. A source-book of biological names and terms. Third ed. Charles C Thomas Publisher, Springfield, Illinois, 323 pp.
- JONES, J. K., JR., D. C. CARTER, AND W. D. WEBSTER. 1983. Records of mammals from Hidalgo, Mexico. The Southwestern Naturalist, 28:378-380.
- JONES, J. K., JR., H. H. GENOWAYS, AND T. E. LAWLOR. 1974. Annotated checklist of mammals of the Yucatan Peninsula, Mexico II. Rodentia. Occasional Papers, The Museum, Texas Tech University, 22:1-24.
- KIM, K. C. 1966. The species of *Enderleinellus* (Anoplura, Hoplopleuridae) parasitic on the Sciurini and Tamiasciurini. The Journal of Parasitology, 52:988-1024.
- KUNS, M. L., AND R. E. TASHIAN. 1954. Notes on mammals from northern Chiapas, Mexico. Journal of Mammalogy, 35:100-103.
- LAYNE, J. N. 1954. The os clitoridis of some North American Sciuridae. Journal of Mammalogy, 35:357-366.
- LEÓN-PANIAGUA, L., E. ROMO-VÁZQUEZ, J. C. MORALES, D. J. SCHMIDLY, AND D. NAVARRO-LÓPEZ. 1990. Noteworthy records of mammals from the state of Querétaro, Mexico. The Southwestern Naturalist, 35:231-235.
- LEOPOLD, A. S. 1959. Wildlife of Mexico: the game birds and mammals. University of California Press, Berkeley, 568 pp.
- LOOMIS, R. B. 1969. Chiggers (Acarina, Trombiculidae) from vertebrates of the Yucatan Peninsula, Mexico. University of Kansas, Museum of Natural History, Miscellaneous Publications, 50:1-22.
- MOORE, J. C. 1961. Geographic variation in some reproductive characteristics of diurnal squirrels. Bulletin of the American Museum of Natural History, 122:1-32.
- MURIE, A. 1935. Mammals from Guatemala and British Honduras. Miscellaneous Publications of the Museum of Zoology, University of Michigan, 26:1-30.
- MUSSER, G. G. 1968. A systematic study of the Mexican and Guatemalan gray squirrel, *Sciurus aureogaster* F. Cuvier (Rodentia: Sciuridae). Miscellaneous Publications of the Museum of Zoology, University of Michigan, 137:1-112.
- NELSON, E. W. 1898. Descriptions of new squirrels from Mexico and Central America. Proceedings of the Biological Society of Washington, 12:145-156.
- . 1899. Revision of the squirrels of Mexico and Central America. Proceedings of the Washington Academy of Sciences, 1:15-110.
- . 1901. Descriptions of two new squirrels from Mexico. Proceedings of the Biological Society of Washington, 14:131-132.
- PETERS, W. 1863. Machte eine Mittheilung über neue Eichhornarten aus Mexico, Costa Rica und Guiana, so wie über *Scalops latimanus* Bachmann. Monatsberichte der Preussische Akademie der Wissenschaften zu Berlin, pp. 652-656.
- THORINGTON, R. W., JR., AND L. R. HEANEY. 1981. Body proportions and gliding adaptations of flying squirrels (Petauristinae). Journal of Mammalogy, 62:101-114.
- TRAUB, R., M. ROTHCHILD, AND J. F. HADDOW. 1983. The Rothschild collection of fleas. The Ceratophyllidae: key to the genera and host relationships with notes on their evolution, zoogeography and medical importance. Academic Press, London, United Kingdom, 288 pp.
- VILLA R., B. 1948. Mamíferos del Soconusco, Chiapas. Anales del Instituto de Biología de la Universidad Nacional de México, 19:485-528.
- WARNER, D. W., AND J. R. BEER. 1957. Birds and mammals of the Mesa de San Diego, Puebla, Mexico. Acta Zoologica Mexicana, 2:1-22.
- WELLS, N. M., AND J. GIACALONE. 1985. *Syntheosciurus brochus*. Mammalian Species, 249:1-3.
- WILSON, D. E. 1983. Checklist of mammals. Pp. 443-447, in Costa Rican natural history (D. H. Janzen, ed.). The University of Chicago Press, Chicago, 816 pp.
- WILSON, D. E., AND D. M. REEDER (EDS.). 1993. Mammal species of the world: a taxonomic and geographic reference. Second ed. Smithsonian Institution Press, Washington, D.C., 1206 pp.
- Editors of this account were J. ALDEN LACKEY, ELAINE ANDERSON, and KARL F. KOOPMAN. Managing editor was JOSEPH F. MERRITT.
- T. L. BEST, DEPARTMENT OF ZOOLOGY AND WILDLIFE SCIENCE AND ALABAMA AGRICULTURAL EXPERIMENT STATION, 331 FUNCHESS HALL, AUBURN UNIVERSITY, ALABAMA 36849-5414.